CLAIMS

[1] A motor driver comprising:

a back electromotive force detection section that detects a back electromotive force appearing in a motor coil of a direct-current motor and outputs a detection signal; and

a speed control section that, based on the back electromotive force detected by the back electromotive force detection section, sets and outputs a current value of a drive current fed to the motor coil,

wherein the motor driver further comprises:

an offset calculation section

that first establishes a state in which the direct-current motor cannot be driven via the motor coil and thus no back electromotive force appears,

that then reads, as a first output, an output of the back electromotive force detection section as obtained when the current value of the drive current fed to the motor coil is made equal to zero,

that then reads, as a second output, the output of the back electromotive force detection section as obtained when the current value of the drive current fed to the motor coil is made equal to a predetermined value,

that then calculates, based on a difference between the first and second outputs, an offset that appears in the output of the back electromotive force detection section as a result of a change in an internal resistance of the motor coil, and

that then eliminates the offset by changing an amplification factor of the back electromotive force detection section.

[2] The motor driver of claim 1,

wherein the back electromotive force detection section comprises:

a detection resistor of which one end is connected to one end of the motor coil;

a first resistor of which one end is connected to another end of the detection resistor;

a second resistor of which one end is connected to another end of the first resistor;

a first differential amplifier circuit

of which one input terminal is connected to a node between the first and second resistors,

of which an output terminal is connected to another end of the second resistor, and

of which another input terminal is connected to a node between the motor coil and the detection resistor; and

a second differential amplifier circuit

of which one input terminal is connected to an output from the first differential amplifier circuit, and

of which another input terminal is connected to another end of the motor coil,

wherein the offset that appears in the output of the back electromotive

force detection section as the result of the change in the internal resistance of the motor coil is eliminated by the offset calculation section varying the second resistor by a resistance value proportional to the difference between the first and second outputs.

[3] The motor driver of claim 2,

wherein the back electromotive force detection section further comprises:

an analog/digital conversion circuit that performs analog/digital conversion so that an output, in a range from zero to Vc, from the second differential amplifier circuit is converted into an n-bit digital signal, and

wherein,

let an initial value of a resistance value of the second resistor be Rx,

let the first output outputted from the analog/digital conversion circuit be X1, and

let the second output outputted from the analog/digital conversion circuit be X2, then,

when the predetermined value to which the drive current is made equal to is positive, a resistance value of the second resistor is set to be $Rx \times (1 - (X2 - X1) / 2n - 1)$, and,

when the predetermined value to which the drive current is made equal to is negative, the resistance value of the second resistor is set to be $Rx \times (1 + (X2 - X1) / 2n - 1)$.

[4] The motor driver of claim 3,

wherein the second resistor is composed of

n resistors connected in series and having resistance values of Rx/20, Rx/21, Rx/22, . . . , Rx/2n–2, and Rx/2n–1, respectively, and

n switches connected in parallel with the n resistors, respectively, and

wherein

the offset calculation section outputs an n-bit digital signal, of which a k-th bit as counted from a highest bit is used to turn on and off, in the second resistor, the switch connected parallel with the resistor having a resistance value of Rx/2k–1, and,

when the predetermined value to which the drive current is made equal to is positive, the offset calculation section outputs an n-bit digital signal corresponding to 2n – 1 – (X2 – X1) to the n switches of the second resistor, and,

when the predetermined value to which the drive current is made equal to is negative, the offset calculation section outputs an n-bit digital signal corresponding to 2n – 1 + (X2 – X1) to the n switches of the second resistor.

[5] The motor driver of claim 3,

wherein

let an absolute value of the predetermined value to which the drive current is made equal to be Io,

let a resistance value of the detection resistor be Rs,

let a resistance value of the first resistor be R1, and

let an amplification factor of the second differential amplifier circuit be A, then

a relationship

$$Vc = A \times Io \times Rs \times (2Rx) / R1$$

is fulfilled.

[6] The motor driver of claim 4,

wherein the second resistor is composed of

n resistors connected in series and having resistance values of Rx/20, Rx/21, Rx/22, . . . , Rx/2n–2, and Rx/2n–1, respectively, and

n switches connected in parallel with the n resistors, respectively, and wherein

the offset calculation section outputs an n-bit digital signal, of which a k-th bit signal as counted from a highest bit is used to turn on and off, in the second resistor, the switch connected parallel with the resistor having a resistance value of Rx/2k–1, and,

when the predetermined value to which the drive current is made equal to is positive, the offset calculation section outputs an n-bit digital signal corresponding to 2n – 1 – (X2 – X1) to the n switches of the second resistor, and,

when the predetermined value to which the drive current is made equal to is negative, the offset calculation section outputs an n-bit digital signal corresponding to 2n – 1 + (X2 – X1) to the n switches of the second

resistor.

[7] The motor driver of claim 1,

wherein the motor driver further comprises a subtraction section that eliminates the offset appearing when no back electromotive force appears, and

wherein

a difference between a third output outputted from the back electromotive force detection section when no back electromotive force appears and the first output is stored, in the offset calculation section, as the offset appearing when no back electromotive force appears, and

a value obtained by subtracting from the output of the back electromotive force detection section the difference between the third and first outputs as stored in the offset calculation section is outputted as the detection signal.

[8] The motor driver of claim 1,

wherein the back electromotive force detection section and the speed control section are built into a single semiconductor integrated circuit device.

[9] The motor driver of claim 7,

wherein

the detection signal from the back electromotive force detection section is outputted to an external control circuit, and

a value calculated by the control circuit based on the detection signal is inputted to the speed control section.

[10] A magnetic disk apparatus comprising:

the motor driver of one of claims 1 to 9;

the direct-current motor driven and controlled by the motor driver;

a magnetic head that moves in a direction of a radius of the magnetic disk by being fed with a driving force of the direct-current motor;

a spindle with a center of which the magnetic disk is engaged; and

a ramp area that is provided outside the magnetic disk and in which the magnetic head is stored away,

wherein,

when the magnetic head is kept in contact with the spindle or an inner wall of the ramp area, an offset that appears in the output of the back electromotive force detection section as the result of the change in the internal resistance of the motor coil of the direct-current motor is calculated by the offset calculation section, and

the offset is eliminated by changing the amplification factor of the back electromotive force detection section.